East Waterway OU

Anthropogenic Background Small Working Group Meeting #4

Invitees: EPA, East Waterway Group (Port of Seattle, City of Seattle, and King County) Muckleshoot Tribe, Suquamish Tribe

December 4, 10 – 11:30 am

Agenda

1. AB Dataset Decisions
2. Arsenic
3. Sensitivity Analysis
4. Work products for Meeting #5

Attachments

Small Group Meeting #4 presentation

Attendees

EPA

- Ravi Sanga
- Elizabeth Allen

USACE (on behalf of EPA)

- Bill Gardiner

Suquamish Tribe

- Alison O'Sullivan

East Waterway Group (EWG)

- Brick Spangler (Port of Seattle)
- Jeff Stern (King County)
- Debra Williston (King County)
- Pete Rude (City of Seattle)
- Merv Coover (ERM on behalf of the City)
- Dan Berlin (Anchor QEA on behalf of EWG)
- Greg Brunkhorst (Anchor QEA on behalf of EWG)
- Deb Chiavelli (Anchor QEA on behalf of EWG)

Meeting Notes

Dan: We prepared the materials just ahead of this meeting, and have one slide we updated just this morning, so we will send out a revised presentation after this meeting.

Ravi: Ecology will attend the large group meeting in January

Greg [Slide 2]: We will review dataset decisions that were provided by EPA, we will review some arsenic considerations, and will review sensitivity analysis that we've mostly already seen as a group.

[Slide 3]: next week's meeting is intended to review the outline and tables/figures from the memo. We may have some things to discuss next week as follow up to this meeting.

[Slide 5]: This summarizes EPA's document provided on Monday. The non-highlighted bullet items are what we agree with, but we'd like to discuss the highlighted items a bit more today. We agree with excluding Aroclor data, that there are no outliers, and excluding sediment traps. We'd like to discuss fines normalization further today. We agree the base case analysis would not include weighting of river conditions. For dioxin/furan individual congeners, we have some new information we'd like to present today. We agree with the proposed summing rule. We have made good progress as a group.

[Slide 6]: Here are the results, just presented here for our reference, with number of samples, mean, and UCL95, as presented in past meetings. Next meeting, we want to show this again with the UCL95 and the assumptions behind each UCL, including whether it used Kaplan-Meier and the distribution that was assumed. We'd like to take one more step to clarify how they were calculated next meeting.

Debra: so for next meeting, it would be great if we came together on what statistics are used to calculate the UCL95?

Greg: yes. We've done non-parametric bootstrapping and want to make sure we're all on the same page with our methods for that. For D/F TEQ, these are based on the congener statistics above. So the TEQ is calculated on the statistics rather than TEQ by sample.

[Slide 7]: Regarding EPA statement on fines normalization, I think I know what you are getting at but it would be good if someone from EPA provided some clarity on the fines normalization rationale.

Bill: the concern is that even when we're normalizing sediment for grain size, there is still a contribution from those larger grain size fractions that based on the modeling don't make it to the East Waterway.

Elizabeth: the higher concentrations are associated with the smaller size fractions, and even if you normalize a portion of the larger size fraction, it's not clear to me that it would not bias the data lower. When you look at the data with and without the fines normalization, and if different techniques don't yield substantially different results, I'd recommend we use the simplest method. It's important to be aware of this method that can be used in the sensitivity analysis.

Greg: Ok, that's generally how we interpreted EPA's comment. Fines normalization does have validity with respect to the conceptual site model. We understand that there are some concentrations associated with sand, but they're not as high as the fine-grained fraction. There are some potential analyses we could do, including fines normalization that accounts for that sand contribution based on the available data we have. The last bullet is related to some past King county work. There are some ways that comparative concentrations can be understood for a range of grain sizes on a theoretical basis.

Jeff: there is a lot of literature that looks at the relationship between concentration, particle size, organic carbon content and surface area, which is a way to normalize data to account for concentrations on different particle sizes. The portion of the PCBs would be assigned to the finer fraction rather than all of the solids.

Elizabeth: Well I think basic physics will show you that. The ratio of surface area to mass is going to be greater for a smaller particles than a larger particles.

Jeff: there's good data that backs that up.

Elizabeth: so does geometry. I'm trying to understand why this is a sticking point, so we can plan to discuss it further today.

Jeff: we'd like to explore this further and to determine if it makes for a better approach to solve the issue we're facing. Whether it's the base assumption or part of the sensitivity analysis, that can play itself out, but we'd like to evaluate further.

Elizabeth: I have no objection about that but I want to be clear that burden of proof is going to fall on you guys. And if two techniques give the same answer the easiest is the best one.

Greg: we will see the effect of fines normalizing that we're presenting later, so this will come back up. Any other thoughts?

Ravi: we'll talk about this among ourselves and get back to you.

Greg [Slide 8]: Debra will present his material

Debra: I dug back into how we calculated our D/F RBTCs in Appendix C of the SRI. We looked at congener patterns in tissue, frequency of detection, and primary contributors of the TEQ of the 17 congeners. Based on that info, we identified 4 congeners that are the primary contributors to the TEQ risk, and we calculated the RBTC for those 4, using site specific biota-sediment accumulation factors (BSAFs). There is a lot of detail in Appendix C, and we can spend more time on that next meeting after folks have time to digest. For setting cleanup levels, we use risk-based values, unless background concentrations are higher. For those 4 congeners that were the primary contributors to the seafood consumption pathway, one of those 4 has an AB value that is below the sediment risk-based value. OK, so if we are looking at AB for 17 dioxin/furan congeners instead of TEQ, we will have to evaluate this step, and right now, only 4 of those congeners are the primary contributors to risk, and for one of those 4, you would use the risk value instead of the AB concentration if you did not go back to the TEQ approach.

[Slide 9]: we believe TEQ is the best approach for a compliance statistic. Using a TEQ allows us to focus on the highest risk congeners while still including all of the congeners. When we calculate the TEQ after doing the statistics for each individual congener, it addresses concerns about different dioxin/furan sources. This minimizes the potential for future decisions to focus on congeners that don't contribute much, if any. to the risk, like OCDD. It's more consistent with the LDW to use a TEQ approach. And it helps with risk communication.

Greg: I mentioned in another call that I get worried about compliance and we have not worked out what compliance would be like. The basic theme is that as we add constituents, the noise in the data becomes more acute with more constituents. One constituent, with UCL 95 has a 5% chance that a future site mean would exceed that and be a false positive, but as you move up to a larger number of constituents, it could be up to half the time of identifying a problem when there isn't one. This could lead us to thinking there's a problem when there's not.

Debra: I'd like to open up the conversation for others particularly when thinking about the RI and risk.

Ravi: Regarding the improved risk communication, communicating TEQ is challenging. I've been dinged by my communications staff with questions about what it is. And in terms of noise on the data I need to think about that. I'll let Elizabeth to continue. She is the expert

Elizabeth: I went and looked at Appendix C of the SRI this morning. You mentioned there are 4 congeners that contribute the majority of risk, which is 1 less than we have at Portland Harbor, which is informative. We calculated background in Portland Harbor that contributed 85-95% of the risk, which was 5 congeners. It's more complicated in Portland harbor, as the congener pattern in sediment concentrations vs tissue concentrations were not as consistent as what is present in East Waterway. Pelagic fish in Portland Harbor was substantially different than sediment in Portland

Harbor. LDW did what they did, that was back in the 2000s- and I'm not sure consistency with that is the most compelling argument for decisions on this site, as we would be using natural background if we followed LDW. We have discussed this issue with our management with EPA, and I have informally discussed it with my management, and we are not going to budge off of calculating background on individual congeners. If we focus only on those that contribute risk, it will eliminate the risk of false positives. I don't have any objections to calculating TEQ for background and comparing it to the risk-based TEQ because background is a higher value. And that gives EPA the ability to not use the risk-based concentrations in a ROD. I would focus the background on those 4 with the biggest risk. Which one had the risk based concentration greater than background?

Debra: yes, it was 2,3,7,8-TCDF, which has a 0.1 toxic equivalent factor (TEF).

Elizabeth: Focusing on congeners that pose the greatest risk makes the most sense.

Debra: I agree

Elizabeth: this is consistent with the decision documents we have made since LDW, including Portland Harbor

Debra: the risk is based on the TEQ and not based on the congener concentration, toxicity is based on 2,3,7,8-TCDD, which we have a cancer slope and a reference dose (RFD) for. I want to stress even with this approach you need to go to TEQ.

Elizabeth: I can explain the concept of a TEQ vs individual concentrations, but my experience is it has been easier to focus on individual concentrations and explain what risk they pose. I can understand here can be challenges with interpretation, but I would rather do things the right way than go through less trouble trying to explain it.

Debra: but I meant that ultimately to explain the potential risk, you do have to ultimately calculate a TEQ to compare to the slope factor and RFD

Elizabeth; the TEQ applies to a slope factor and you calculate for each of these individually, but like every other risk, you sum them up

Ravi: but it doesn't land in the environment as a TEQ

Debra: The TEF just generates a weighted sum. We understand the comment about calculating the statistics and then calculating a TEQ.

Pete: can we step back to that table on slide 7 to see what 4 or 5 we are talking about?

Debra: 2,3,7,8-TCDD (with TEF of 1), 2,3,7,8-TCDF (which has a lower background), 1,2,3,7,8-PeCDD, and 2,3,4,7,8-PeCDF.

Pete: So they have low concentrations

Debra: yes but they have higher TEFs

Elizabeth: I did it a different way – how much is each one contributing to total TEQ. Most of the time there are three that stand out in terms of double digits, most are really low. 1,2,3,6,7,8-HxDF is 10% of total, a couple are in the neighborhood of 7 to 9% and it falls off after that

Bill: it would be helpful to see a table of relative contribution to risk. Understood that primary contributors are the more toxic fractions but there may be value in including beyond four, like six for example. I think including AB values for those that contribute on the order of 5 to 10% of the total risk would be worthwhile.

Elizabeth: do you know what percentage those four were of the total dioxin/furan risk?

Debra: there are figures in Appendix C that represent risk in tissue based on consumption. One shows detection frequency, percent of concentration, and percent of TEQ, which is percent of risk. EPA and EWG decided that those 4 congeners were most important to develop BSAFs for so we could develop risk based numbers. So EPA was part of this discussion. I am highlighting the four that were already determined in SRI.

Elizabeth: but we are excluding clams?

Debra: there are a lot of non-detects in clams

Elizabeth: excluding clams, I am seeing 91 to 83% of risk is posed by those 4 congeners and that range is exactly consistent to what we decided at Portland Harbor. There it did not work out as well due to low frequency of detection in background. There is much better data here and we can calculate meaningful background on these four.

Debra: on slide 7, I was not using this background data to decide contribution to risk, I was looking at site tissue data to consider portion of risk

Elizabeth: and that's much more informative than the exercise I did this morning, so it's easier to pick things out based on what's posing the risk

Debra: agree

Elizabeth: we used a version of the same but we used a version of the food web model in Portland Harbor, where they bioaccumulate a bit differently. What's posing risk in the point of contact is different with what's posing risk in sediment.

Bill: so the percentage of risk from those four is greater than 90%. Is that correct?

Debra: we can get that for next meeting

Bill: sure. The % contribution to risk from those 4 compounds was greater than 90% of the total risk? Is that correct?

Debra: I can check, but we did not say what percent in that appendix

Elizabeth: For English sole, surf perch, and excluding clams, it was 91, 93, and 83% of the total risk

Debra: I agree when ballparking by looking at the graph

Bill: it would be good to justify whatever subset we're using, and if we're in the 90s, that seems good. But we're not using BSAFs at all, right?

Debra: that's correct. Selecting the congeners to use from the Green River dataset is based on the tissue data at the site that the risk is based on.

Bill: OK, BSAFs are often dodgy

Debra: but in order to know if the background sediment number is above or below risk you do need to use BSAF to determine that. So BSAFs do come into play when trying to determine the cleanup level.

Elizabeth: but you only established BSAFs for those four, correct?

Debra: correct

Elizabeth: that points more to a stronger line of evidence for using just those 4. We do want to rely on the process that got us here today.

Debra: that's true

Bill: choosing those with highest risk helps us deemphasize concentrations we are less concerned about, like OCDD or OCDF. But I wonder if showing this table or equivalent in an appendix would be useful if we did need to look back at what an AB value is for a TEQ.

Debra: that seems fine to me, as we're interested in the compliance point. The info would be there.

Elizabeth: you did a good job of reminding me Debra that this isn't exactly what it is at the point of fish if we try to do comparisons

Debra: this was late breaking. I'm glad we're all circling back to this. So for next meeting, do you want to explore any of this further? Bill I'll make sure you get Appendix C. Think about if you want anything expanded for next time.

Jeff: I would suggest we should generate the 4 AB concentrations and identify what the RBTC is for those 4

Debra: yes that's easy to do.

Elizabeth: internally here at EPA, we may want to brief some level up to our management. It should not be a hard sell because this is consistent with other sites, but I always like to make sure we get their buy in.

Debra: I thought that was part of the purpose of the January check in meeting as well.

Elizabeth: I just want to make sure this works with my management

Pete: so are we still collectively looking at this piece? Have we reached a tentative conclusion?

Greg: I'm hearing that we're calculating for the 4, comparing to those RBTCs and comparing to the ABs for those 4?

Debra: yes, pending Elizabeth's discussion with management

Elizabeth: if there is any skepticism, I will do my best to convince them. This is the most logical way to go forward.

Jeff: one of the concerns we need to think about is this is not consistent with the way Ecology thinks about this.

Ravi: it's not consistent, but is it a huge deviation? Isn't it scientifically justified? I'm not as convinced they wouldn't buy into it

Elizabeth: I'm not as convinced that they would buy into it. There have been other conversations about how Ecology interprets background as written in SMS that has involved attorneys. EPA feels strongly that this whole approach that we're taking on EW is the appropriate way to move forward.

Greg [slide 11]: this is somewhat open-ended conversation. If you look at the arsenic data, the mean is around 17 mg/kg in suspended solids, but the surface sediment SWAC in the EW is 9 mg/kg and the mean is 11 mg/kg. We want to make sure we have a scientifically justifiable AB number here. There are a couple of reasons we've considered in helping to understand this difference, in that arsenic is associated with very fine-grained particles that are not settling in EW, possibly from the Asarco plume that was atmospherically depositing arsenic with really fine-grained particles. It's also possible that the natural point source of arsenic in the vein that's below the Howard Hanson dam, and that naturally occurring arsenic is a very soft mineral that could be very fine grained as well. Another potential is that arsenic is sensitive to redox in sediment that could mobilize arsenic out of

sediment. In the next few slides, we present bedded sediment data that provides extra information as we think about this.

[Slide 12]: Here is the Green River bedded sed data. Is this more consistent with the site or what we're seeing in suspended solids? The table presents summary statistics on these box plots. We broke into fine grained and sand. Bedded sediment is around 10 mg/kg using USGS composites and Ecology bedded sediment from 2007. Turning basin cores data were compiled in LDW DER report and are also around 10 mg/kg.

Bill: I was a little surprised to see 17 mg/kg, and I went back to look at some of the previous presentations. How did you get to 17 mg/kg? Regardless of whether it was a baseline or a storm event, it seemed like everything was centering around 11 mg/kg.

Greg: On slide 7, this is a straight mean of these 52 samples. I can provide additional QC on that.

Debra: can you pull up the suspended solids data from the previous presentation?

Greg: generally what we see is 10 mg/kg and 11 mg/kg in bedded sediment, and 17 mg/kg in suspended sediment. Last meeting, Elizabeth acknowledged those are high concentrations.

Elizabeth: when I said it was higher than I expected I didn't mean I didn't believe it

Bill: after looking back, it does look like it's in the range you show.

Greg: Yes, looking back at last meeting's presentation, this is consistent with numbers in previous presentations

[Slide 13]: this slide shows sites that have been previously cleaned up. We looked at these in the FS for PCBs and dioxin/furans, and we added arsenic for the same datasets. These numbers are falling in a similar range of bedded sediment elsewhere.

Jeff: these are multiple years post-cleanup after they have equilibrated with background. They are not the sand concentrations immediately following cleanup.

Greg: Ecology did a study in 2007 in Elliott Bay. This data has been presented in the context of PCBs and dioxin/furan for LDW and EW, and we've added arsenic, which is in a similar range for other bedded sediment samples. Does anyone have any initial thoughts or reactions about how to present the arsenic background values in light of this info?

Debra: it's also something we can revisit next Wednesday if you want to have some time to think about it. The suspended solids data is what it is, and we have some theories, particularly with the Asarco plume, which is so fine it doesn't settle.

Greg: natural background is 7 mg/kg, and that's based on the Bold dataset. That is lower than we're seeing in EW and at other cleanup sites.

Bill: one of the things that's brought us to this point is that sediments that are coming in are 9 to 11 mg/kg, and there was reluctance to use 7 mg/kg as the cleanup level. But it's 17 mg/kg that's coming in. It's particularly challenging, as I don' t know how you'll parse that out as it could get complicated very quickly to modify that number.

Greg: so maybe this is something that is part of the uncertainty discussion in our memo.

Elizabeth: post-remedial concentrations in slide 13 eventually do settle out in the LDW and in the West Waterway, but the sill keeps coarse grained sediment from settling out in the EW. But maybe not a lot of settling is happening in the EW, but that leads us to question the CSM.

Debra: but the LDW bedded sediment average is also below 17 mg/kg

Elizabeth: what you're seeing in LDW is consistent on the west side

Merv: my personal opinion is that biogeochemistry is fundamentally governing the steady state of arsenic concentrations in bedded sediments. We don't have the data to demonstrate that, but it's consistent with the scientific literature. It's possible to explain using geochemistry as mediated by organisms in sediment.

Elizabeth: the geochemical reactions would affect the bioavailability of the arsenic. But I would think we would quantify all arsenic.

Jeff: it's not quite that simple. Bedded sediment does not involve dissolved arsenic that could be removed or leaving sediment. Even if you speciate the arsenic, the total is still lower than after these complex reactions take place. We don't know whether there is any meaningful method to correct. Or maybe you need post-cleanup data to see what background data will look like.

Elizabeth: I would lean against doing a correction, as this is what we're seeing. It would be more problematic if we had a lower AB and higher site concentrations. We aren't in a situation that we are above background. As long as site performance monitoring data is consistent with 17 mg/kg, we're in compliance. My biggest concern is that we would be above a lower number during monitoring.

Bill: does arsenic drive the cleanup footprint?

Dan: no, other COCs drive the cleanup footprint, and where arsenic is above the RAL, other COCs are also above their RAL.

Greg: PCBs are the driver for the cleanup footprint

Jeff: we wouldn't have to change the RAL, right?

Greg: correct

Debra: Looking at FS maps, right around the former Rabanco loading area, and near slip 36 are the only areas above the arsenic RAL. Very little exceeds the RAL.

Ravi: also near T25 that had elevated arsenic by the beach?

Debra: that was PAHs

Ravi: I thought there was also arsenic

Bill: The RAL for arsenic is 57 mg/kg. To tie up the arsenic conversation it sounds like you want to look into the high background issue a bit more and as far as incoming suspended sediment concentrations, whether that seems ok to use as a background is something we can discuss next time.

Merv: I am not sure we can delve more into the whys. I think it's more that we can come to an appropriate technically justifiable conclusion about this.

Greg: Can we have this conversation in context of the memo outline next meeting?

Merv: we should certainly talk about it. It would be good for EPA to ponder this more. Unlike dioxin/furan and PCBs, arsenic is labile and subject to other influences and mechanisms that the other COCs are not. It's interesting that the numbers are settling out not that much above the natural background estimate, and to get a refined estimate of AB beyond what we're seeing with the other lines of evidence, it seems like it's going to be right around 9 or 10 mg/kg, but how do you justify using 9 or 10 mg/kg.

Elizabeth: If we were to sit down and write the ROD today, if we said 17 mg/kg is what's coming into EW today and so 17 mg/kg is the compliance point, would you object to that?

Debra: Let's move onto the next slide and follow up on this next week.

Greg [Slide 15]: This slide and the next are different views of the same data. Each row grouping is a different sensitivity analysis. We used TEQ for dioxins/furans because it's the handy one to use. The midpoint (0 percent) is the base case that we are using for AB on these slides. This shows the change to the mean, not UCLs. For PCB Aroclors, the mean goes down slightly if include them. If you add in sediment traps, concentrations go down. If you fines-normalize, concentrations go up. If you screen out samples with <60% fines, concentrations go up. If you do the flow and precipitation weighting, dioxin/furan and arsenic go up but PCBs goes down. The bottom set is based on the mass of Green River sediment vs mass of lateral inputs, so if you include the lateral input mass, the

percent change is on the order of 5% higher for PCBs and dioxin/furan, which is not a huge amount but arsenic goes down slightly.

[Slide 16]: this is a different view of the same data, and the colors show their relative impact on the mean. For the next meeting, we should confirm people are on board with this approach and whether we want to add or subtract anything and how we may present it.

Ravi: I'm trying to understand the previous slide. Why does the histogram go the other way?

Greg: all the ones towards the left are getting smaller. So if you add in the sediment trap data, the sand in the traps brings down the mean on the order of about 8%.

Ravi: With the laterals, which I thought we weren't including, it looks like it's a very small contribution

Greg: right

Ravi: so what is the purpose of the figure again?

Greg: the purpose is to compare how the decisions that we've made for the base case to develop AB differ from some of the decisions that could make with some of the other data.

Bill: this is a nice clean way to present it in one piece, and I like the presentation. For next meeting, can you provide bullet points for what to take from each of these?

Elizabeth: my take away from this figure is that the fines normalization has the greatest contribution to the uncertainty. And you were going to think about it more.

Jeff: we settled on this presentation in the FS for an uncertainty analysis for the modeling. If you would have changed things, it shows what effect it would have on the data, and it worked well last time.

Elizabeth: as I've said, when a complicated technique and a simple technique give you the same answer, I prefer the simple. I'm surprised how much influence fines normalization has.

Dan: and remember this is on the base case mean not the UCL

Jeff: We can look into that too next time

Ravi: Allison, anything else from the tribe?

Allison: no

Dan: so for next meeting we'll plan to prepare bullets that summarize the sensitivity analysis, present alternate fines normalization methods, and present the outline for the AB memo and a list of

information we expect to present to the large group in January. Elizabeth if you get different feedback on the dioxin/furan approach, please let us know.

Debra: and we'll also present dioxin/furan congener AB values compared to RBTC

Ravi: we are also doing meeting notes from this meeting, right?

Dan: yes

Bill: will we also settle on which statistic?

Debra: Yes

Dan: right, we will also present the distributions used for each UCL.

Debra: this is a lot of information for next meeting, so we'll have to move through materials quickly.

Dan: Talk to everyone on Wednesday.